SOIL CONSERVATION

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A MESSAGE FROM THE SECRETARY OF AGRICULTURE

Soil erosion control, to be effective, permanent, and economically feasible, involves more than the use of vegetative and engineering methods. It involves, also, general land-use planning, proper crop rotations, controlled livestock grazing, and the application of other sound farm-management practices. Hence, practically every branch of the Department is concerned, should be called on, and should cooperate at all times in shaping and carrying forward a practicable program. Similarly, the Soil Conservation Service should cooperate with the other branches of the Department in order to utilize to the greatest extent possible all existing resources and information.

It is largely through cordial working agreements with the State colleges, the experiment stations and the extension services that the Department is accustomed to reach the individual farmer. And it is upon such agencies that we are relying for practical assistance in making the soil conservation program effective.

Many have spoken to me of the sincere desire of officials in all branches to help make this new undertaking a truly successful one. I am very much gratified, too, by reports coming to me from the field. The spirit which pervades soil conservation ranks everywhere enables us to go forward with confidence.

H A Wallace

EXPANDED DEMONSTRATION PROGRAM GETS UNDER WAY

Ninety-four new erosion control projects were announced on August 5, with allocation by the President of $27,500,000 of Works Relief funds.

Selection of areas was premised on relief rolls, erosion conditions, cooperative attitude of farmers, and suitability for demonstration purposes. Sites were inspected by State agricultural agencies and representatives of the Soil Conservation Service in advance of designation.

Wide Coverage

The expanded program, including as a nucleus the 47 existing projects, will embrace demonstration areas in 41 States. The average unit of operations will approximate 25,000 acres in size.

Regional directors, backed by the experience gained under the first 2 years of erosion-control work, are reported everywhere as prepared to get the new projects under way speedily. They have been instructed that under the provisions of the Works Relief Act, they must draw 90 percent of the additional labor required from local relief rolls wherever possible.

Varied Treatment

A variety of land problems will be encountered among the new demonstrations, involving many forms of gullying, sheet erosion, flood and wind destruction. The enlarged program will deal with a cross-section of erosion conditions of agricultural America. It will involve comprehensive land planning and farm management. In some places dams will be built or gullying otherwise checked. Terraces will be constructed. Strip-cropping, contour cultivation, and forestation will be extensively employed. Plant introductions and native vegetation will be used. Combinations of two or more of these measures will be brought to bear in most instances.

Many Groups Involved

As heretofore, success will be contingent upon the cooperation of farmers, civic groups, agricultural agencies, State and local officials.

A number of States will have erosion-control projects for the first time, among them Florida, Idaho, Indiana, Maine, Maryland, Michigan, Montana, Nevada, North Dakota, Utah, and Wyoming with 1 each.

Texas, the largest State in area, also leads in the number of projects with 10 new ones and 3 already under way. Oklahoma comes next, with a total of 10 projects, 8 of which are new.

Following is the distribution in other States:

Alabama.—Two new projects. One existing project.

Arizona.—Two existing projects.

Arkansas.—Four new projects. Two existing projects.

California.—Three new projects. Three existing projects.

Colorado.—Two new projects. Two existing projects.

Georgia.—Three new projects. Two existing projects.

Illinois.—Two new projects. One existing project.

Iowa.—Four new projects.

Kansas.—Three new projects. One existing project.

Kentucky.—Two new projects. One existing project.

Louisiana.—Four new projects. Two existing projects.

Minnesota.—One new project. Three existing projects.

Mississippi.—Four new projects. One exisiting project.

Missouri.—Three new projects. Two existing projects.

Nebraska.—Two new projects. One existing project.

New Jersey.—Two new projects. One existing project.

New Mexico.—One new project. One existing project.

New York.—Two new projects. One existing project.

North Carolina.—Five new projects. Three existing projects.

Ohio.—Three new projects. One existing project.

Oregon.—One new project. One existing project.

Pennsylvania.—Three new projects. One existing project.

South Carolina.—Three new projects. Two existing projects.

South Dakota.—One new project. Two existing projects.

Virginia.—One new project. Two existing projects.

Washington.—One new project. One existing project.

West Virginia.—One new project. One existing project.

Wisconsin.—Two new projects. One existing project.

ACT OF CONGRESS ASSURES PERMANENCE TO SOIL CONSERVATION PROGRAM

Because of its vital interest not only to members of the Soil Conservation Service but to everyone interested in conservation and in agriculture, we reproduce Public, no. 46, passed by the Seventy-fourth Congress on April 27, 1935, "To provide for the protection of land resources against soil erosion, and for other purposes."

On the day the act was approved the Secretary of Agriculture officially designated the Soil Erosion Service as the agency to carry out its provisions. Thus the emergency Soil Erosion Service became the permanent Soil Conservation Service.

AN ACT

To provide for the protection of land resources against soil erosion, and for other purposes.

Be it enacted by the Senate and House of Representatives of the United States of America in Congress assembled, That it is hereby, recognized that the wastage of soil and moisture resources on farm grazing, and forest lands of the Nation, resulting from soil erosion, is a menace to the national welfare and that it is hereby declared to be the policy of Congress to provide permanently for the control and prevention of soil erosion and thereby to preserve natural resources, control floods, prevent impairment of reservoirs, and maintain the navigability of rivers and harbors, protect public health, public lands and relieve unemployment, and the Secretary of Agriculture, from now on, shall coordinate and direct all activities with relation to soil erosion and in order to effectuate this policy is hereby authorized, from time to time—

(1) To conduct surveys, investigations, and research relating to the character of soil erosion and the preventive measures needed, to publish the results of any such surveys, investigations, or research, to disseminate information concerning such methods and to conduct demonstrational projects in areas subject to erosion by wind or water;

(2) To carry out preventive measures, including, but not limited to, engineering operations, methods of cultivation, the growing of vegetation, and changes in use of land;

(3) To cooperate or enter into agreements with, or to furnish financial or other aid to, any agency, governmental or otherwise, or any person, subject to such conditions as he may deem necessary, for the purposes of this Act; and

(4) To acquire lands, or rights or interests therein, by purchase, gift, condemnation, or otherwise, whenever necessary for the purposes of this Act.

Sec. 2. The acts authorized in section 1 (1) and (2) may be performed—

(a) On lands owned or controlled by the United States or any of its agencies, with the cooperation of the agency having jurisdiction thereof; and

(b) On any other lands, upon obtaining proper consent or the necessary rights or interests in such lands.

Sec. 3. As a condition to the extending of any benefits under this Act to any lands not owned or controlled by the United States or any of its agencies, the Secretary of Agriculture may, insofar as he may deem necessary for the purposes of this Act, require—

(1) The enactment and reasonable safeguards for the enforcement of State and local laws imposing suitable permanent restrictions on the use of such lands and otherwise providing for the prevention of soil erosion;

(2) Agreements or covenants as to the permanent use of such lands; and

(3) Contributions in money, services, materials, or otherwise, to any operations conferring such benefits.

Sec. 4. For the purposes of this Act, the Secretary of Agriculture may—

(1) Secure the cooperation of any governmental agency;

(2) Subject to the provisions of the civil-service laws and the Classification Act of 1923, as amended, appoint and fix the compensation of such officers and employees as he may deem necessary except for a period not to exceed eight months from the date of this enactment, the Secretary of Agriculture may make appointments and may continue employees of the organization heretofore established for the purpose of administering those provisions of the National Industrial Recovery Act which relate to the prevention of soil erosion, without regard to the civil-service laws or regulations and the Classification Act, as amended; and any persons with technical or practical knowledge may be employed and compensated under this Act on a basis to be determined by the Civil Service Commission; and

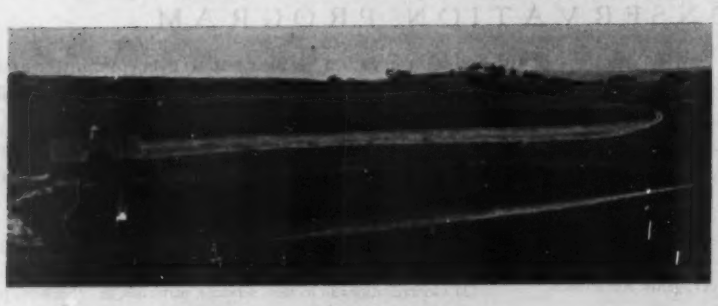
(3) Make expenditures for personal services and rent in the District of Columbia and elsewhere, for the purchase of law books and books of reference, for printing and binding, for the purchase, operation, and maintenance of passenger-carrying vehicles, and perform such acts and prescribe such regulations as he may deem proper to carry out the provisions of this Act.

Sec. 5. The Secretary of Agriculture shall establish an agency to be known as the "Soil Conservation Service", to exercise the powers conferred on him by this Act and may utilize the organization heretofore established for the purpose of administering those provisions of sections 202 and 203 of the National Industrial Recovery Act which relates to the prevention of soil erosion, together with such personnel thereof as the Secretary of Agriculture may determine, and all unexpended balances of funds heretofore allotted to said organization shall be available until June 30, 1937, and the Secretary of Agriculture shall assume all obligations incurred by said organization prior to transfer to the Department of Agriculture. Funds provided in H. J. Res. 117, "An Act making appropriation for relief purposes" (for soil erosion) shall be available for expenditure under the provisions of this Act; and in order that there may be proper coordination of erosion-control activities the Secretary of Agriculture may transfer to the agency created under this Act such functions, funds, personnel, and property of other agencies in the Department of Agriculture as he may from time to time determine.

Sec. 6. There are hereby authorized to be appropriated for the purposes of this Act such sums as Congress may from time to time determine to be necessary.

Approved, April 27, 1935.

STRIP-CROPPING TERMS DEFINED



Typical strip-cropping near East Bethlehem, Pa.

In a recent revision of the mimeographed circular, Strip Cropping, by Lyman Carrier, chief agronomist, and Walter V. Kell, associate, several terms are defined which are frequently used in discussing the practice of strip-crop farming as applied to erosion control.

The practices, because of varying conditions, are not always uniform in different States; therefore, a better understanding of the terms used in describing them should result in a clearer conception of these practices

The term " strip-cropping ", as applied to a cropping practice employed by the Soil Conservation Service, means the production of crops in long strips placed crosswise of the line of slope approximately on the contour. The width of the strips will vary, depending on the erodibility of the soil and the degree of slope.

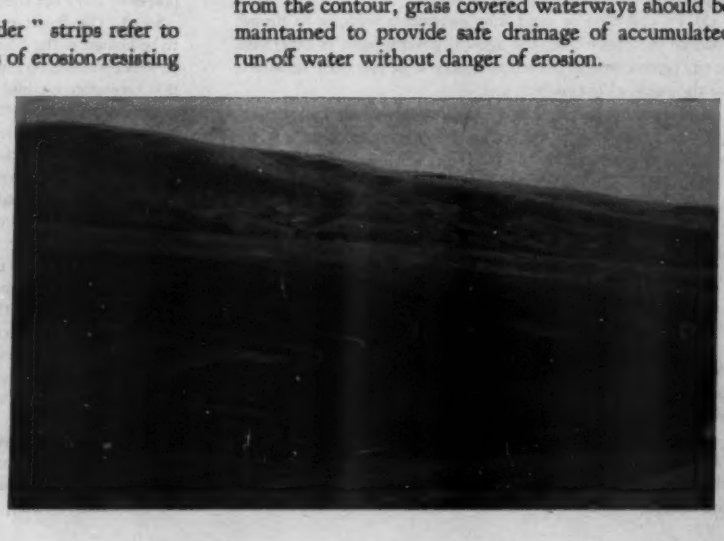
The term " field-stripping " refers to a modified form of strip-cropping in which the field is divided into straight parallel strips laid out crosswise of the general slope.

The terms " buffer " or " spreader " strips refer to narrow, permanent, contour strips of erosion-resisting vegetation which are not a part of the rotation and may or may not be harvested. The strips are usually about one drill's width or wider. Buffer or spreader strips may also be composed of small grain, legumes, or sod usually seeded ahead of the general field seeding.

" Rotation strip-cropping " is a term referring to the rotation of the general farm crops grown in the strips.

These systems should not be confused with permanent strips, where trees, vines, briar berries, honeysuckle, and grass are grown on especially vulnerable parts of slopes to afford permanent protection.

Under conditions where it can be practiced, strip cropping is an effective method of controlling erosion. It is especially suited to general farming regions where a hay crop is an important feature of the cropping system. The principle involved can be practiced on any slope capable of being cultivated, but it is essential that the fields or strips be laid out as nearly as practicable on contour lines. When the strips deviate from the contour, grass covered waterways should be maintained to provide safe drainage of accumulated run-off water without danger of erosion.



Buffer or spreader strips; one drill's width (10 feet) of winter wheat seeded in the spring on summer-fallow ground. Eastern Washington.

HOW SILT IS MEASURED ON PROJECT STREAMS

By John A. Allis

Stillwater Creek Project

The appearance of a muddy stream of water naturally raises the question as to how much soil material is being carried out of the area drained by that stream. To obtain definite information regarding this subject, measurements of the actual flow of water and determinations of the amount of material carried in suspension by three streams in the soil erosion project at Stillwater, Okla., are being made by the United States Geological Survey.

As the flow of streams during periods of low water is affected by the ground-water conditions, it is important to know the fluctuation of the ground-water table. This fluctuation is determined by making observations on the ground-water level in wells scattered throughout the project.

Many Readings Required

Results of determinations of load of suspended material and of observations of ground-water levels must be obtained for a considerable period of time in order to afford a reliable index to the changes that are likely to take place.

Two stream-gaging stations, one on Stillwater Creek and one on the West Fork of Brush Creek, are located within the project area. Another gaging station on Council Creek outside the area duplicates as nearly as possible the physical features of the other two stations. Investigations made at these three stations will give a comparison of stream flow, ground-water levels, and silt movement on the project area with that of a similar untreated area.

Each of the stations is equipped with an automatic gage-height recorder housed in a wooden shelter, which is provided with an outside and an inside staff gage, a stilling well, and an intake from the stream. These recorders, which are visited at frequent intervals by the resident engineer, furnish a graph which shows the actual state of the stream at all times.

Basis for Calculations

Discharge measurements are made by the hydrographer which show the amount of water, in cubic feet per second, passing the gage. A record is kept of each discharge measurement and of the stage of the stream at the time it is made. With a sufficient number of reliable discharge measurements made throughout the range of stage of the stream together with the gage-height graph, it is possible to make a rating curve from which the discharge at all times can be calculated.

Silt samples are collected daily during periods of normal flow. During flood stages samples are collected at intervals ranging from half an hour to two hours. Each sample is marked, showing the time, gage height, and sampling point. Usually three samples are taken for each set.

These samples are analyzed for silt content, in parts per million, at the field laboratory. The Washington office takes up the computations at this point and determines the quantity of silt passing the gaging station. These computations show the loss of soil from land in the drainage area.

Ground-Water Fluctuations

In addition to the 3 gaging stations described above, 16 wells supplied by ground water and 9 rain-gage stations are maintained. One of the wells is equipped with a water-stage recorder, which shows the height of the ground water at all times. The other wells are visited weekly and readings made to show the fluctuation of the ground water. Three of the rain-gage sta-

Hydrographers measuring flow of water. In the background may be seen a recording gage house.

tions are equipped with self-registering recorders which show the amount, intensity, and duration of the rain. The other stations are standard rain gages, which are visited daily by the observers.

Difficulty has been experienced in collecting all the desired data, as the run-off is large and the peak flows are of relatively short duration. Several of the peak flows have occurred at night, and due to the weather conditions that cause such rises, the work has been hampered. A lighting system is being developed whereby it will be possible to make discharge measurements at night. It has, however, been the practice to collect silt samples at all hours.

During periods of normal flow it is necessary to make discharge measurements at frequent intervals in order to detect any changes in the relation between stage and discharge and to develop the rating curve to greater accuracy. During such periods it is possible to complete the field data which have been collected, in order that they may be submitted to the district and Washington offices for further computations and publication.

Since the data are of so technical a nature, much time and study are required to determine fully the effect of soil and moisture conservation practices on stream flow, silt loads, and ground-water level. For this reason no final computations have yet been made.

TEACHING LAND THRIFT TO HIGH SCHOOL BOYS

Realizing that the high-school boys of today will be the farmers of tomorrow, and that the inculcation of principles of land preservation in the minds of the students will be definitely reflected in the farming practices of the future, school officials and directors at Minden, La., have arranged that practical class instruction in erosion-control work be given to every high-school youth in Webster Parish.

Supt. E. S. Richardson and the 10 high-school principals of the parish have agreed to excuse high-school boys from their regular studies for 3½ days a month in order that they may take advantage of classes conducted by department heads of the local project.

Varied Experience

A. H. Bean, soils expert, and J. W. Hammett, in charge of game conservation and rodent control, will explain and demonstrate the work of their departments. A. C. Morris, agronomist, and F. S. Edmiston, chief engineer, will direct the students in the actual work of building a terrace, constructing a terrace outlet and varied types of dam structures in gully control. In addition, the principle of strip-cropping will be explained and a strip-crop planted by the boys.

W. E. Dee, chief of range management, will put in approximately an acre of pasture, again having the high-school boys do the actual work. A. S. McKean, forester, will explain his phase of the work and the value of trees and forest areas to the farmer, and have the school boys plant a small forest tract.

The plots upon which the program will be carried out are so located that students can follow up the first work and see from day to day the advantages of the program being put into use on the farms of this area.

"We want every high-school boy in the parishes where we may be operating to have first-hand information regarding the type of work which we are putting into practice in this section", says H. M. Mimms, acting regional director. "Our work with the schools of Webster Parish was so successful and was met with such enthusiasm by the pupils, the parents, and the teachers that we expect to carry on during the next school year on an enlarged scale. There is no better method of sending our practices and plans of proper land utilization and preservation into the farm homes of our area than through the high-school boys, most of whom already live on farms."

From the South Tyger River project, South Carolina, comes word of a transplant bed established at Duncan, where 1,200,000 loblolly pine seedlings, too small for field planting the past season, have been transplanted.

The wild-life work in the Coon Creek watershed, Wisconsin, has shown considerable progress since its beginning in the spring of 1934. Farmers in the area planted several hundred patches of mixed grains for the feeding of game birds during the winter. Cover plantings of spruce, wild plum, vines, and so forth, were installed with the food patches for further protection.

Although he has but recently terraced his land, Dave Cameron, in the Fishing Creek area, South Carolina, reports that a 2.18-inch rainfall failed to cause any breaks. Six waterways were made on the 325 acres.

PASTURE CONTOURING ACHIEVES MULTIPLE RESULTS

By D. V. Stapleton

Okatibbee River, Miss., Project

Contour furrowing in pastures—with which this article is particularly concerned—is proving its several values on the Okatibbee River project, where it is rapidly gaining headway as a farming practice.

Here it is demonstrating its value in conserving moisture, in conserving fertility, in checking and preventing erosion, in keeping grass seed from washing away, and in controlling run-off water, thereby minimizing flood dangers.

The popularity of contour furrowing is growing not only with the local soil erosion staff but with farmers within the area, and is meeting with approval among business and professional people and leading citizens throughout the State of Mississippi. Hill farmers are interested in it as a device for conserving fertility, preventing erosion and holding moisture. They hail its ability to hold on the pasture the grass and clover seeds, that would in many cases travel with the water down the slopes to the streams below. Lespedeza seed is very light in weight and is easily carried down slopes by water. Citizens located in lowlands and Delta sections are also becoming enthusiastic about contour furrowing of open pastures and idle lands on the slopes above and even suggest that all sparsely-timbered slopes be treated similarly as a means of minimizing flood conditions. Many pastures in the southeastern part of the United States were formerly cultivated fields and in many cases the old row ridges can still be seen. These ridges do not interfere with mowing. Yet, if constructed on the contour they would unquestionably have a considerable water-holding power. Such ridges or rolls are from 4 to 6 inches high.

Furrows Become Rounded

Contour furrows have a rather rugged appearance immediately after they are constructed. Mowing would probably be impossible the first year. Some farmers have raised objection on that account, but the rains, cattle, and other natural means will smooth these furrows down, after which they will have the appearance of a roll and will not materially interfere with mowing. Contour furrows are usually placed from 20 to 30 feet apart, depending upon the slope, but they may be placed closer since they are inexpensive and can be built by the farmer himself at odd times.

The accompanying illustration gives an idea of the contour furrows as they appear in this section. The staking out of contour furrows in pastures is much more simple, from an engineering standpoint, than the designing of a terracing system on cultivated areas. There are no set rules as to the location of contour furrows. It is largely a matter of putting into use plenty of common sense. An average person, with some experience, can stake out and lay off furrows on the contour, since one of the main objectives is to hold the maximum amount of water. In order to increase the holding capacity each end should be turned up the slope slightly. Care should be exercised to construct the furrows so as to prevent concentration of water that will run off. For the average land in this section, four furrows with an 8-inch turning plow is sufficient.

Each lineal foot of contour furrow 6 inches high on a 10-percent slope has a water-holding capacity of 1.75 cubic feet, or 13.09 gallons.

It must be remembered that when the slope of land is increased four times, the speed of water flowing over it is about doubled; the cutting power is multiplied by 4, the power to carry soil is multiplied by 32, and the size of particles it can carry is multiplied by 64 (Wisconsin Circular No. 249).

Variables Enter

There are a number of variables entering in that make it impossible to figure the amount of water that a given number of contour furrows may prevent from reaching the streams below in a given time, but we do know the actual holding capacity. In other words, if a 4-inch rain falls during a 24-hour period, these variables make it impossible to determine the amount of water that soaks into the ground and the amount that gets away. It is very probable, however, that during a heavy rainy spell of from 48- to 72-hours duration, contour furrows should cause to soak into the ground and evaporate from 2 to 4 times their holding capacity.

During dry summers when pastures begin to fail, the grass is greenest just above the contour furrows. The conclusion reached by the McNeill, Miss., Branch Experiment Station is that these furrows in pastures can be justified from a moisture-holding standpoint alone, even in a humid area. We are of the opinion that pasture contour furrowing in the hill section of Mississippi can be justified from the standpoint of either of the purposes mentioned herein. It is perhaps the general belief that not only pasture slopes, but sparsely timbered slopes, as well, should be contoured. This would suffice until sparsely timbered areas could be reforested and the young trees take hold.

Project no. 21 at Meridian has contoured more than 2,000 acres of pasture slopes on 80 farms. A method that seems to be satisfactory is to run contour lines at twice the distance of the intervals desired and simply plow a furrow half way between. This furrow may not be exactly on the contour at all points, but if care and practical judgment is exercised it will serve the purpose well.

Theoretically, the water-holding capacity of the contour furrows on a 640-acre pasture with an average 10 percent slope and furrows averaging 20 feet apart is approximately 20,000,000 gallons of water. Contour furrows prevent concentration of water. They therefore give the denuded and overgrazed spots a chance to become well sodded again.

Woven Wire Useful

From the Sangamon River, Illinois, project comes the suggestion that idle rolls of woven wire be put to the task of checking gullies. An observer there has noted many such rolls of old wire lying about farms, some of them reposing in gullies in such a way as to add to the erosive action.

The Soil Conservation Service has built several thousand dams of wire, brush, and posts. Hedge brush and posts were used in most of the dams and were furnished by the farmers. Several thousand dams of other types have been constructed with materials which cost little, such as brush and posts, rock, earth, and sod.

A feature which makes these gully dams valuable is that any farmer can build them. They should be so constructed that water can flow neither around them nor under them.

Typical method of constructing pasture contour furrows.

ONE HARD RAIN DID THIS

By E. B. Deeter

Soil Erosion Experiment Station, Temple, Tex.[1]

A single torrential rainfall gave dramatic emphasis recently to the value of strip-cropping as a means of preventing soil losses. As a result of the careful records which have been kept by the Soil Erosion Station at Temple, Tex.—which, in turn, are the progeny of ingenious methods and devices of measurement—we are able to gain a fair portraiture of what happens to mother earth when the forces of man and nature unite in a work of mischief.

Serves Wide Area

The station serves approximately 15,000,000 acres of land, comprising the blackland prairie and part of the grand prairie. The principal soils are Houston clay or Houston black clay (blackland prairie), and San Saba or Crawford clay (grand prairie).

The rainfall of April 2, ranging at different places from 1.09 to 1.72 inches, produced some striking results. The rate of intensity was approximately 4 inches per hour. Land planted to corn, with rows up and down a 4-percent slope, eroded at rates ranging from 5 tons to nearly 10 tons per acre in terms of dry soil. The actual sludge or mud washed from the same areas during this single rain, ranged from 9.65 to 14.89 tons per acre. The run-off ranged from 43 to 50 percent of the total rainfall of 1.72 inches.

Bad Practices

Most of the cultivated crops in the blackland region of Texas have the crop rows up and down the slopes, and the evils of this practice were thus readily apparent.

The value of oats as a means of vegetative control of soil erosion was indicated by the fact that land having a crop of oats on a 4-percent slope, incurred soil losses ranging from only 0.01 ton to 0.2 ton per acre of dry soil. The run-off from this oat field ranged from as low as 0.4 percent to 3.34 percent of the total rainfall of 1.72 inches.

[1] In cooperation with the Texas Agricultural Experiment Station.

Land having a cover of Bermuda grass on a 4-percent slope, sustained a soil loss of only 0.02 ton per acre, dry weight, while the run-off was 1.33 percent.

Comparison Drawn

On April 2, other areas, with slopes varying from 4 to 6 percent, received a rainfall of 1.09 inches, most of which fell within a period of 15 minutes. A field strip-cropped to oats and land bedded for cotton, incurred a soil loss of 0.48 ton per acre, dry weight. An adjoining area, having rows bedded for cotton up and down the slope, sustained a soil loss of 10.66 tons per acre. The actual weight of sludge or mud washed from this field was 14.2 tons per acre. In other words, strip-cropping was more than 22 times as effective in preventing soil erosion as the normal practice for the region.

No Added Expense

In addition to this remarkable contrast, attention is called to the fact that very little, if any, extra expense is required to follow the practice of strip-cropping. All that is required is to have alternate strips of feed crops (oats, sudan, red-top cane) on contour, which means that the crop strips are laid out across the slopes somewhat similar to terrace lines. The strips ordinarily may vary from 75 to 100 feet in width.

For the Texas blackland region, winter oats are considered to be one of the most effective erosion-control crops because of the fact that the land is protected during the greater part of the year and especially during the periods when most of the rainfall is normally incurred.

It will be many years before it is physically possible to terrace all of the land in Texas that is adaptable to this type of protection against erosion. It is, however, easily within the means of practically every farmer to practice strip-cropping. This will often prove to be a good substitute until such time as terracing is achieved. Indeed, where slopes are not too steep, strip-cropping is a practice which many believe might be continued independently.

FREE SOIL FROM A NEIGHBOR'S ORCHARD

By Harry E. Reddick

Regional Director, California Project

One barranca—Californian for gully—robbed a landowner of more soil in 41 years than he could have hauled away in a truck if he had spent every day carrying his ranch down to the river and dumping it in.

Soil erosion is a menace in California second only to the indifference of the people whose handling of the land most certainly will decide the agricultural future of the State.

Erosion Common

As a rule, the citrus fruit grower is pretty smart. He has to be if he is to pay a dividend on land that he has purchased at city-lot prices, and on which he has a large overhead in taxes, fertilizers, pest control, and water. But if you think erosion isn't commonplace in California fruit orchards, take a drive through any of the foothill sections after a winter storm. It is erosion that causes those deposits of soil and sand across the highways in many places. Much of that soil came from around the tree roots in somebody's orchard. Erosion caused those roots to be exposed along the upper edge of those older groves; and erosion brought that fine sharp sand down that has covered the bud unions on those young trees, which will have to be replanted if they are to stand a 50-50 chance against gummosis. The greater part of whatever value your land has, in an agricultural sense, lies in those few inches of top soil. And yet there are growers who will say there is no erosion problem in citrus orchards, when trees in the upper ends of their own holdings appear to be standing on the tip ends of their roots, while in the lower slopes the trees begin to fork before they are out of the ground 6 inches.

"Blessings" from Above

What else does erosion do? One orchard was filled in to a depth of 4 feet this year, and another young orchard has had to be replanted three times on account of soil washing down from land above. This free soil that you get from your careless neighbor up above is usually like most free things—pretty much without value. The water that carries it down takes into solution most of the available plant food that the soil originally contained, and leaves the sterile sharp sand behind. Besides that, the introduction of noxious weeds, such as morning glory, devil grass, and puncture vine, as well as root diseases may often be credited to free, but unwanted, soil that came from someone's else land.

What can citrus growers do about erosion in their orchards? On all ground having a slope of 1½ percent or more, depending upon the type of soil involved, the thing to do is plant, cultivate, and irrigate on the contour. Stationary water is never the cause of erosion, and the whole plan of erosion control in southern California is based upon attempts to prevent water from running, because it is running water that carries away the soil. When an orchard is contoured the same thing is done, in a practical sense, that would be accomplished if it were possible to pick up a plot of land and drag a straight edge across it. If an orchard is contoured, on slopes ranging from 4 to 14 percent, and bench terraced with permanently vegetated risers on the land steeper than that, there are but two other safeguards necessary to combat erosion. The main thing is a good cover crop, planted early enough to be able to hold the soil when the first rain comes, and left growing long enough to hold the last rain in the spring; and second, provisions made to carry the excess storm waters safely into the barrancas or watercourses that have been controlled or stabilized by vegetation and soil-saving dams.

Two Ways to Meet Problem

If the orchard is one of the older square-set groves that has already suffered severely from erosion, there are two possible courses to follow: One is to protect what soil there is left, and the second is to haul back the soil which has been carried away and place it about the trees where it came from originally.

Cover crops are undoubtedly the most easily applied, as well as among the most effective erosion preventives known for square-set orchards on sloping ground—if they are planted early enough and left long enough. As stated before, they should be started by irrigation in order that they may be sufficiently mature to protect and hold the soil when the first fall rain comes, and they should be left in place until there is little or no chance of a late rain catching the land unprotected.

There are two common objections to this method of cover crop management; one is that the plants absorb too much precious moisture from the soil, if left growing too long; and the other is that the mature, hardened stems and stalks of the cover crop lock up too much nitrogen and keep it from being available for plant food in the following growing season. Mowing the cover crop before it reaches maturity, and letting the litter lie, will go a long way toward saving the moisture and nitrogen, and at the same time the roots will be there when needed to hold the soil. While soil moisture certainly is a thing to guard in southern California, we can always fall back on irrigation; but soil once gone is usually gone forever.

Slowing the Flow of Water

Shortening the irrigation runs so that a smaller head of water will carry through is a good thing to be considered in square-set orchards, and often the direction of the irrigating furrows can be changed so that they will have a more gradual flow line, thus cutting down the possibility of erosion from irrigation. There are many cases where a complete change from the old gravity system to that of the overhead sprinkling type would be justified by the saving of the soil due to the elimination of long, or steep, irrigation furrows.

The idea of hauling rich agricultural soil from place to place will sound fantastic to many, although for a long time the Chinese have made a practice of completely exchanging the top soils of cultivated plots, and it is being done here in California by progressive growers. The manager of one of the largest lemon ranches in the State recently said that he was never at loss for a place to use his teams in the winter months, because he could always set them to hauling the dirt back up the hill. Another grower equipped himself with a tractor-loading device that enabled him to haul over a hundred loads of soil per day. In realining his irrigation runs he changed them from 4½ percent to around 1½ percent, and although the work has scarcely been completed, he is already convinced that it was profitable investment of time and money.

Halting the Raindrop's Travels

A discussion of soil conservation methods in California without considering water conservation is impossible, because they are both of great importance, and because the control of one automatically implies at least a partial control of the other. The water conservationist seeks to induce the rains to enter the soil, instead of running off the land, in order that the water will remain available for irrigation during the dry months; the soil conservationist attempts to do exactly the same thing, but for a different reason—to keep it from eroding the land as it runs away. "Keep the raindrop where it falls" could well be the slogan for both, and whether the result is accomplished by contour planting, dikes, terraces, cover crops, or soil saving dams, the California agriculturist who practices erosion control, is of necessity killing two birds with one stone. After all, good water is of small value to the grower without good soil to put it on.

Limestone Distributed to Cooperators

Tests show that most of the soil in the Big Creek area, Missouri, has a lime requirement of from 1 to 3 tons per acre. This fact indicates that it is impossible to grow crops having a high lime requirement, such as alfalfa and sweet clover, without applying lime. It has been found that much better crops of red clover may be grown on this land with the use of limestone, and even timothy responds favorably to a sweet soil.

More than 15,000 cubic yards of limestone have been crushed for distribution to farms in this area, in the interest of increasing crop yields and assisting in the control of erosion.

Nine-year-old orange orchard, planted and cultivated on the contour, suffered no damage in storm of December 31, 1933, although planted on a steep hillside.

TERRACING PRACTICES VARY ACCORDING TO CONDITIONS

By T. B. Chambers

Assistant Chief Engineer, Soil Conservation Service

Terraces are being constructed on most of the 40 demonstrational projects, in an area extending from Wisconsin to south Georgia and from New Jersey to the Texas Panhandle. Within this vast territory are encountered a variety of conditions in soils, climate, cultural practices and topography. A wide range of treatments in design and construction are required. Because of the fact that visitors to projects in different sections of the country are often struck with apparent inconsistencies in the terracing program, an outline of conditions and practices is here presented.

The Soil Conservation Service generally bases its terracing procedure upon the recommendations of the several colleges of agriculture. These recommendations are the outgrowth of experience obtained by agricultural workers in adapting practices to local conditions. Naturally, the size, shape, grade and spacing of terraces varies widely throughout this large area and any attempt to attain a standardization would be out of the question. It happens, however, that the conditions upon which terrace designs must be based are so nearly similar in three major subdivisions of this area, and the purposes for which terraces are constructed are so nearly identical within each subdivision, that the three subdivisions will be considered as units. I speak of (1) the Southeastern Piedmont and adjacent upper coastal plains, (2) the Middle West, including the prairie States immediately west of the Mississippi River, and (3) all that portion of the great plains lying east of the Rocky Mountains and west of a north and south line running approximately through the center of Kansas.

We will consider the three subdivisions in the order named:

Piedmont and Adjacent Coastal Plains

The topography is quite similar throughout the entire scope of this region, consisting of short steep slopes and narrow valleys. The slopes are generally eroded, often gullied and present a very rough uneven surface on which terraces are needed. Fields are small, steep and of nonuniform shape. The annual rainfall totals from 40 to 56 inches in frequent downpours which are often of high intensity. The topsoil is characterized by light sandy loams and clays. Cultural practices throughout the region are uniform and generally make use of walking-plows on row crops laid out along the contour. A summation of these conditions shows a highly erodible soil, steep slopes and large annual rainfall with periods of high intensity.

When such land is to be terraced, let us first consider a principle substantiated by experiments on the Soil Erosion Experiment Stations of the Department of Agriculture: That, for many soil types and within the limits of terrace spacing, soil-loss increases and water-loss decreases as the length of slope increases. Or, to state conversely, the shorter the slope the more water loss and less soil loss.

The problem then is to take the water away from the fields in the shortest possible time (moisture conservation is seldom a problem in this section) with minimum soil loss.

To satisfy the conditions and problem, we have small terraces constructed on relatively steep grades, placed at short horizontal intervals and with large water channels extending into the more impervious and less erodible subsoil. By close spacing, the water loss is increased and soil loss decreased. At the same time the total accumulation of water behind a terrace is small and is further reduced by accelerated run-off due to maximum grade along the terrace. The water channel is of maximum size and the ridge is incidental to construction of the channel. Percolation through the ridge is minimized by lowering the channel into the subsoil. The steep narrow ride is not an obstacle to cultivation since small equipment is used and cultivation is on the contour. Terraces in this subdivision are generally 12 to 15 inches high after settlement. The ridges are 12 to 18 feet wide at the base and are constructed on variable grades ranging from 1 to 5 inches fall per 100 feet. The horizontal intervals are such that a mile of terrace protects approximately 9 acres.

Midwest and Eastern Plains

This region is characterized by long undulating slopes ranging in gradient from 3 to 8 percent over a majority of the area with occasional steeper slopes

occurring in some sections. Soils are predominantly silts and silt loams, highly erodible when not protected by vegetation. Annual precipitation is less than in the Piedmont subdivision and ranges from 20 to 40 inches. Periods of high intensity occur frequently in the summer months and this fact is one of the controlling factors in designing the terrace system. Further complicating the matter is the almost universal practice of straight-row cultivation with large machinery, which necessitates crossing terraces.

The problem, then, is the two-fold one of moisture and soil conservation, calling for terraces constructed on flat grades and spaced at relatively wide horizontal intervals. The terraces are unusually long due to large field units, and because of this and a rainfall of high intensity there is a maximum run-off requiring an exceptionally high terrace ridge. The water channel is not of such importance as it is in the Piedmont, since absorption is desirable. Consequently, the terrace ridge is constructed with nearly equal amounts of soil taken from the upper and the lower sides.

The result is a broad, high terrace ranging in width from 18 to 30 feet and in height from 18 to 24 inches, constructed on a variable grade of 0 to 3 inches fall per 100 feet (allowing normal precipitation to be absorbed and peak flows to be discharged) by use of large-blade or elevating graders. The length of some of these terraces is unusually great, extending from one-half mile to a mile. The area protected by a mile of terrace averages 20 acres.

Western Great Plains

The topography here is characterized by very uniform, unbroken, wide, sweeping slopes whose gradients seldom exceed 4 to 6 percent. Rainfall is less than in the other two areas, running from 16 to 20 inches per annum, with relatively low intensities. Predominating soils are light sandy or silt loams, and due to the low annual precipitation wind erosion is a much greater problem than water erosion. Field units are large, often comprising 640 acres or more and the prevailing farming practice is cultivation in long straight rows with power-drawn equipment.

The problem is primarily one of moisture conservation. Terraces are necessarily wide-spaced, of medium height and broad base, and constructed level with the ends closed to prevent discharge. The water channel is not of great importance and, as in the second subdivision cited, the terrace is constructed from both the upper and the lower sides.

These terraces on a steep hillside were made with an especially constructed tractor-drawn gang plow and were finished with a grader. Trees will be planted in these terraced channels.

The resulting level terrace is ordinarily from 18 to 24 feet wide at the base and from 15 to 18 inches in height depending on rainfall intensity and absorptive capacity of the soil. The spacing is such that an average mile of terraces protects 22 acres of land. Heavy-blade graders and elevating graders have proved economical for use here.

It is realized that exceptions to these conditions and practices occur in all three subdivisions. The intention here has been to give an outline of the predominant conditions and prevailing practices, in the interest of a clearer conception of the terracing problems involved. The cultural practices referred to are those prevailing among farmers in the various regions. The Soil Conservation Service is everywhere attempting to encourage the use of contour cultivation.

Recognizing the importance of native plants in erosion control has led to the starting of a survey and the collection of information regarding the distribution of plant life within the Gila River project. Data and specimens are being assembled in the field herbarium located at project headquarters in Safford, Ariz. Visitors to the project are being invited to make use of this valuable material.

EROSION CONTROL IN THE WHEAT LANDS OF THE PACIFIC NORTHWEST

By W. A. Rockie

Pullman, Wash., Project

The initial large-scale effort at erosion control in the Pacific Northwest was begun early in 1934. The first demonstration area selected consists of a small watershed unit of the famous Palouse wheat lands drained by the extreme headwaters of the South Fork of the Palouse River. The watershed, which has an area of 151 square miles, drains westward. The Washington-Idaho State line approximately halves the area. Moscow, in Latah County, Idaho, is near the center of the watershed; Pullman in Whitman County, Wash., is at its foot. The State College of Washington and the University of Idaho are located at Pullman and Moscow, respectively.

The area as a whole has the characteristic Palouse topography; it is like no other region and must be seen to be appreciated. An aerial view of this topography shows on a much larger scale conditions closely resembling sand dunes; but the soil consists of extremely fine silt and clay instead of sand. The windward, or southwesterly, slopes usually have a 20 to 40 percent grade as compared with the leeward slopes of 35 to 60 percent. The aerial photographs show strikingly the lack of glaring clay hilltops in the mountain headwater area, and the terrible frequence of such hilltops in the Palouse topography. This topography is a striking example of geological erosion, on which our civilization is now superimposing a man-made process of soil wastage.

Tree-Like Spread

The south Palouse drainage is of dendritic pattern and mature age. On every portion of the area natural surface drainage is adequate. The South Fork proper drains about half of the watershed, while Paradise Creek, Missouri Flat Creek, and Dry Fork (tributaries which enter the South Fork at Pullman) drain the other half.

On all the area except the mountain slopes and foothills the soil has been classified as Palouse silt loam. This soil as classified includes several rather distinct phases or conditions. The soil on the mountain headwaters consists of residual granitic material with some admixture of wind-blown dust.

The Palouse erosion control project is almost entirely in cultivation. Only at the extreme headwaters on the slopes of the Moscow Mountains and several associated granitic hills is cultivation of the land not complete. These mountainous headwaters are more or less covered by stands of coniferous timber.

Slopes Originally Well Covered

The land was originally "Palouse prairie" with pine and fir forests covering only the extreme headwaters. The Palouse prairie grasslands consisted of a very luxuriant growth of several species of bunchgrass with which were associated some areas of shrubs and, less frequently, trees. The more exposed southwesterly slopes were covered with luxuriant pure grass stands while the more protected slopes had denser stands with frequent shrubs and occasional trees.

Agricultural settlement of the Palouse region began less than 60 years ago. The first cultivation was done in the valley bottoms; later the lower slopes were broken, and finally the upper slopes and hilltops. In the early years of cultivation, every part of each slope yielded generously, but practically all of the hilltops and many of the upper slopes have had all of the topsoil washed away—either out onto the bottom lands or downstream to the river or ocean bed.

Organic Material Removed

During recent decades, agricultural practices, under the wheat-summer-fallow system of farming, have left this land utterly unprotected against the elements for about 12 months out of each 24. The landowners and the farm operators generally, in their efforts to control weeds and to secure the greatest crop yields from the land, have practically "dry-cleaned" the soil. Repeated tillage, fallowing, and burning have so completely destroyed the structure and body of this soil and so seriously decreased the organic matter content that today 10 to 15 percent of the area of the average farm is truly submarginal because of the resultant erosion.

The program of erosion control simply involves some common sense principles of safe use of the land.

Each farm unit is carefully studied as a separate and individual problem. Vegetation forms the foundation for control work in this area. Where it is deemed necessary, mechanical controls also are established.

The clay hilltops and the steepest slopes are seeded to grasses or to grass-legume mixtures, or they are planted to adapted kinds of trees. These are the areas from which the heaviest soil and water losses have occurred; such retirement from cultivation results in almost complete stabilization of the particular areas retired.

Rotation Planned

Much of the cultivated land must continue to produce crops. It is planned that the soil on these areas shall be maintained and rebuilt by means of scientifically safe crop rotations. These rotations must include the practice of green manuring the land. In effect such rotations render the soil more spongelike, mellow, absorptive, and productive. This is the first step toward a constructive, permanent agriculture.

The lowlands, draws, and stream bottoms make up a relatively minor percentage of the land area, but their protection is an important phase of erosion control. Most of the draws are to be kept in permanent plant cover. Where it proves necessary, temporary dams built flush with the bed of the drainway are installed to prevent further damage and destruction.

Revenue from Retired Land

On all of these lands that are being removed from annual tillage, special attention is being given to obtaining the largest possible income from the retired acres. Such income may be in the form of pasture, hay, or seed from the forage seedings, or may consist of posts, fuel, nuts, or fruits from tree plantings. Since these products are obtained from acres that were unprofitably farmed under the old plan, any returns from them add to the net income of the farmer.

Under the agricultural practices which have prevailed, the Palouse lands are deteriorating rapidly, farmers' incomes are becoming steadily less, community prosperity is in turn being affected, and slowly but surely the decline will grip the entire region.

The Palouse area can, should, and must be changed from a one-crop checkerboard of wheat and fallow fields to a region of great diversification in farming and stockraising. In other words, the change must be from a temporary, destructive, short-sighted mining of the land to a sound, permanent, constructive farming system.

Aerial mosaic of south Palouse watershed, Whitman County, Wash., and Latah County, Idaho, by the Soil Conservation Service with the cooperation of the Forty-first Division Aviation, Washington National Guard.

WISCONSIN LAW ENCOURAGES REFORESTATION

An act which is causing widespread interest among conservationists was recently passed by the State Legislature of Wisconsin. It is directed toward gaining the cooperation of farmers in reforestation and aforestation. It is expected to be of important assistance in the general program of erosion control. Here it is—

AN ACT

To repeal subsection (4) of section 77.02 and to create subsection 70.11 of the statutes, relating to the exemption from taxation of farm wood-lots and sloped lands, and providing a penalty

The people of the State of Wisconsin, represented in senate and assembly, do enact as follows:

SECTION 1. Subsection (4) of section 77.02 of the statutes is repealed.

SEC. 2. A new subsection is added to section 70.11 of the statues to read:

"(70.11) (40) (*a*) Any wood lot or wood lots forming an integral, even though detached, part of any improved and regularly operated farm and not exceeding one fifth of the total area of such farm, if the same is enclosed with a legal fence sufficient to keep out horses, cattle, sheep, hogs or other grazing animals.

" (*b*) In addition to the land described in paragraph (*a*), any portion of a regularly operated farm, the slopes of which are of a gradient of more than thirty percent, if the same is enclosed with a fence consisting of not less than three barbed wires and the owner refrains from cultivating, or mowing such portion, grazing any type of livestock thereon and from burning over such land or takes reasonable precautions to prevent such burning; and if the owner makes a reasonable effort to reforest such portion or to revegetate the same with grass or shrubs such as will prevent erosion or excessive run-off.

" (*c*) To obtain such exemption, and a proportionate reduction in the assessed valuation of the entire farm, the owner shall file a sketch and an affidavit with the town clerk setting forth the accurate dimensions of the wood lot described in paragraph (*a*) or of the sloped portion described in paragraph (*b*), in metes and bounds, and showing as to the wood lot that such property does not include any improved lands and is fully stocked with growing trees, has been fenced as herein provided, and certifying that the land will not be pastured; and showing as to the sloped portion described in paragraph (*b*) the percentage of gradient of the slopes thereof, that such portion has been fenced as herein provided, and will not be mowed, burned or grazed as herein provided, and certifying that the owner will make a reasonable effort to reforest such land or revegetate same with grass or shrubs such as will prevent erosion or excessive run-off. Upon the filing of such affidavit the assessor shall make an examination of such wood lot or sloped portion to verify the claims made in such affidavit and determine whether such wood lot or portion is entitled to exemption under this subsection. Upon his certification to this effect, such wood lot or sloped portion shall be exempt from taxation and the assessment of the farm shall be proportionately reduced. For his services in making such examination, the assessor shall be paid a fee of two dollars by the owner of such property. Any assessor who shall maliciously and wilfully refuse to allow an exemption of lands qualifying for exemption under this subsection or who shall fail to proportionately reduce the assessment of the entire farm or verify the claims made in the affidavit, shall be liable to the penalties prescribed in section 348.264.

" (*d*) The exemption from taxation of the lands described in paragraphs (*a*) and (*b*) shall continue as long as such lands are used exclusively for the purposes specified in said paragraphs and comply with the conditions thereof. A list of all lands exempted under this subsection shall be prepared each year by the town clerk, stating the name of the owner, location and approximate area of the land exempted, and such list shall be posted for the annual town meeting in the town hall. When such exempted lands cease to be so used or no longer comply with all of the requirements of this subsection, the exemption from taxation shall terminate and such lands shall be returned to the tax roll.

" (*e*) The board of review shall annually review all exemptions under this subsection and shall hear and pass upon the complaints of any owner or citizen who may appear before said board in regard to exemptions applied for or granted hereunder."

SEC. 3. This act shall take effect upon passage and publication.

A Review—DEBT BURDEN AND SOIL CONSERVATION

Part of the second report of the Iowa State Planning Board Ames, Iowa, April 1935, pages 27–28–29. Based on the economic and sociological survey made by Iowa State College, Ames, Iowa, in cooperation with the University of Missouri, on farms located within the Big Creek watershed of the Soil Conservation Service, Bethany, Mo.

A heavy debt burden tends to stimulate heavy cropping, particularly at a time of falling price level. The conspicuous increase in the corn acreage throughout Iowa and Missouri during 1930 and 1932 undoubtedly reflects, in part, this increased debt pressure.

The survey shows that the percentage of crop land in the Big Creek watershed in corn increased from 32 percent on farms practically clear of debt to 43 percent on farms with a mortgage of $51 or more per acre. The percentage of farm land in crops also increased from 51 percent to 72 percent with increasing size of mortgage per acre.

The conclusion is, among other things, that the effectiveness of any soil conservation program could be substantially increased by relieving the soil from financial pressure created by excessive mortgage indebtedness.—C. REED HILL, Salt Creek Project, Zanesville, Ohio.

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